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Promising Danish test installation reducing sulphur (SO_x) and particle (P.M.) emissions from the ships' exhaust gases

An environmental technology development project between boiler manufacturer Aalborg Industries, diesel engine manufacturer MAN Diesel, shipowners DFDS, the Danish Environmental Protection Agency and the Danish Shipowners' Association will optimize the use of exhaust gas scrubbing systems for ships as a cost-cutting alternative compared to switching to fuel oil with a low or no sulphur content.

Big challenges for the shipping industry

The shipping industry faces daunting challenges in the coming years due to the new international regulations concerning lower emission of sulphur from the ships. In coastal areas (so-called SECA = sulphur emission control areas) such as the Baltic Sea and the North Sea, the sulphur contents in the ships' fuel oil must be cut from the present 1.5% to 1.0% in 2010 down to 0.1% in 2015. Or in other words a reduction of 93%. For remaining oceans the sulphur contents in the fuel must be reduced from the present 4.5% today down to 3.5% in 2012 and 0.5% in 2020, or a reduction of 89%.

A vital alternative

In order to fulfil the new requirements, the shipowners have two options: Either the switch to marine fuel with a low or no sulphur content – or they instigate cleaning of the ship's exhaust gases. The traditional fuel with low or no sulphur content, such as marine diesel oil (MDO) or distillate, is today far more expensive than the previously used heavy fuel oil (HFO), and it is expected that in order to supply the huge amount of marine diesel oil, a considerable increase of refinery capacity is required. Cleaning of exhaust gases from the ships will consequently be a vital alternative and a supplement to use of fuel with a low or no sulphur content. Apart from cleaning of sulphur oxide (SO_x), the exhaust gas scrubbers have also proved more effective in removing harmful particles (also called Particulate Matter, P.M.) from the exhaust gases of the diesel engines when compared to switching solely to marine fuels with low sulphur content.

Tests with "washing" of the exhaust gas

Aalborg Industries has developed a so-called scrubber capable of cleaning the exhaust gas from the ship's main engines by "washing" the exhaust gas with water (seawater or freshwater mixed with caustic soda). When sprayed over the exhaust gas, the water has a chemical reaction with the sulphur dioxide (SO_x) in the exhaust gas which is then neutralized which considerably reduces the emission of sulphur oxides and particles.

The first generation of the exhaust gas scrubber was installed onboard DFDS' Ro-Ro ferry "TOR FICARIA" which sails the route between Gothenburg in Sweden and Immingham in the United Kingdom. As part of the product development, the scrubber system will be tested in actual operation until December 2009 after which the parties involved in the test (Aalborg Industries, MAN Diesel and DFDS together with the Danish Environmental Protection Agency will evaluate the results. The Aalborg Industries scrubber installation onboard "TOR FICARIA" is the biggest scrubber unit in operation so far anywhere in the world as the main engine has an output of 21 MW.

Environmental technology development project

Scrubbers are a known technology for land-based installations where they are mainly used for cleaning of exhaust gases from stationary power plants. For maritime installations, the technology is used for the so-called inert gas systems which



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Aalborg Industries has manufactured and markets for more than 30 years. Based on Aalborg Industries' know-how from these plants, the project is being further developed and modified for installation after diesel engines. Before the installation onboard, the scrubbing system and the process was tested at the MAN Diesel test centre in Denmark last year. The development project has financial support from the Danish Environmental Protection Agency's fund for environmentally efficient technology, and it is one of the major environmental technology development projects in the Action Plan for Cleaner Shipping introduced by the Danish Environmental Protection Agency and the Danish Shipowners' Association on 17 March 2009.

Target to reduce sulphur emission by 98%

"For the international shipping industry, the potential for this technology is huge. Our scrubber system test ashore indicates a potential of a 98% reduction in sulphur dioxide emissions and a 80% reduction in particle emissions for the exhaust gases of ships when operating on traditional bunker oil (HFO). The task ahead of us now is, in co-operation with DFDS and MAN Diesel, to optimize the plant during actual commercial operation that will enable us to verify the promising results in reality", says President & CEO Jan Vestergaard Olsen of Aalborg Industries A/S.

Benefiting the environment – and our competitiveness

"We took an immediate interest in the scrubber technology and readily opted to place our ship at disposal for the test. We are a Northeuropean freight and passenger shipowning company and operate many vessels in coastal regions so we have a natural interest in supporting development of technologies that ensure cleaner air and environment. Of course we hope that the exhaust gas scrubber technology – provided we achieve the same results as in the land-based tests – will not only help us meet the new requirements to reduced sulphur contents in the emissions but will even remove particles from the exhaust gas. This will both benefit our environment but also secure the future of sea transportation which in turn is an advantage to the environment and our infrastructure", says managing director Niels Smedegaard, DFDS.

Further information

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Facts about exhaust gas scrubbers and the development project

In test installations, scrubbers have been used for exhaust gas scrubbing/cleaning behind main engines of up to 10 MW. The team's task has been to develop a scrubber that works optimally after large diesel engines, at varying exhaust gas amounts from the ship's main engine, during continuous operation, and with as low a back pressure from the engine and



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as low a water consumption as at all possible. A proto type of the scrubber will be tested on DFDS' Ro-Ro ferry "TOR FICARIA" from July to December 2009, followed by a report on the operational/technical consequences and the the overall economy of the installation. The development project also comprises the task of providing input to the Danish Environmental Protection Agency about guidelines for scrubber installations and discharge of the wash water used in the scrubber unit. Exhaust gas scrubbers are also part of the development project "Green Ship of the Future" which concerns development of new technologies and solutions for new shipbuilding.

Facts about Partnership for Cleaner Shipping

The Danish Environmental Protection Agency joined the Danish Shipowners' Association in November 2008 to establish Partnership for Cleaning Shipping with the purpose of reducing air pollution from shipping in Denmark and globally. The partnership was established to address a number of tough new requirements to the Danish and international shipping industry adapted by the United Nation's International Maritime Organisation (IMO) in October, 2008.

In March 2009, the Partnership issued an Action Plan for Cleaner Shipping with 10 key activities within three focus areas:

- Charting of the air pollution from the shipping industry
- Development of environmentally friendly technologies and know-how aimed at reducing nitrogen oxide (NO_x) and sulphur emissions from the shipping industry
- Contributions to Danish and international legislation in the area